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LOUIS AGASSIZ

Louis Agassiz: His Life and Correspondence. Edited by Elizabeth Cary Agassiz. Two Volumes, 8vo. (London: Macmillan and Co., 1885.)

SELDOM has the influence of early environment been more marked in a scientific career than in the life of Louis Agassiz. Born in 1807 at the little village of Motier, in the plains of Switzerland, he passed his childhood on the shores of the Lake of Morat, the waters of which were a perennial source of delight to him. He took more special interest in its living things; knew the haunts and habits of its fishes, and could lure them to him by various ingenious boyish spells, or track them to their hiding-places in the old walls that were lapped by the water. He began to collect birds, insects, shells, and other objects long before he had acquired any book-knowledge of natural history. Between the Lake of Morat and the larger expanse of the Lake of Neuchâtel lies a strip of fertile country rich in woodlands and flowers, and full of bird-life. On the further side of Lake Morat, towering above the scene of the great battle wherein the Swiss routed the army of Charles the Bold, rise the far snowy summits of the Bernese Oberland. Nursed amid these surroundings, and encouraged and guided by wise parental care, the child most truly was father to the man. His intense love of nature and of all living creatures developed into the enthusiasm of one of the foremost naturalists of the time. His childish devotion to the fishes of Lake Morat settled into the earnest and untiring spirit of research among living and extinct fishes which made him the leading ichthyologist of Europe. His passion for the mountains with their snow-fields and glaciers grew into that clear insight and power of philosophical generalisation which have placed the name of Louis Agassiz at the very head of the pioneers by whom the story of the wonderful Ice Age has been unravelled.

The ardent boy with his eager pursuit of natural history was designed for commerce. His father, a poor country clergyman, had no fortune at his disposal which could save his son from the necessity of choosing a profession. But the studies and discipline of school life by no means checked the boy's longing for some career that would enable him to follow his bent towards the prosecution of science. He begged for two years more of the College at Lausanne, and this was granted by his parents, who, though they seem to have been quite aware of his peculiar abilities, never allowed themselves to lose sight of the necessity that their son should at all events qualify himself for some honourable means of making his own livelihood. His future appears to have been considerably influenced by a medical uncle at Lausanne, who, recognising the lad's special bent, suggested that he should take to medicine. This advice being followed, young Agassiz went for two years to the Medical School at Zürich, and then, at the age of nineteen, betook himself to the life of a German student at Heidelberg. It was there that his scientific career received its first great impetus, and that it became certain that, though he might persevere with his medical studies and take his degree, he would ultimately distinguish himself and make his career, not as a physician, but as a naturalist. At Heidelberg he laid the foundations of some of the most precious and enduring friendships of his life, more particularly with Alexander Braun the botanist, whose sister he afterwards married, and with whom and Schimper he next year migrated to Munich, famous at the time for the varied attainments of its professors of science and philosophy. Entering there on a wider field of study, Agassiz and his comrades distinguished themselves among the students by their enthusiastic devotion to natural science. Meeting at each other's rooms, they formed a band known outside as "the Little Academy," discoursing on all manner of questions, starting new problems, proposing solutions for old ones, and creating so much interest in their proceedings, that even learned professors were sometimes to be seen among their listeners.

It was but natural that in the midst of such a life the drudgery of the medical profession should grow more and more irksome. Again and again warning comes from home that the practical aim of his University studies must not be lost sight of, and that he must surely qualify himself to practise as a doctor. His mother's strong common sense would from time to time brush away the golden haze through which the hopeful enthusiast looked at his prospects. In her letters too, she warned him against his "mania for rushing full gallop into the future," engaging in too many different undertakings, and wasting by diffusion an energy which would carry him successfully to his goal, if he would only concentrate it upon what was essential for the purpose. Long before he took his medical degree his power of original research in ichthyology was widely known, and Martius placed in his hands for description the Brazilian fishes left undescribed by Spix. This work was completed and published in 1829, when the young author was only twenty-two years of age. Next year he gratified his parents by formally taking the degree of M.D.

But the prospect of settling down as a country medical practitioner was more than ever distasteful to him, though there seemed no very clear outlook in any other direction. He himself, however, was full of hope. His Brazilian fishes had brought him no money indeed, but it had given him a reputation throughout Europe as one of the rising naturalists of the day. Already he was full of schemes for the production of a work on fossil fishes, and he had actually made considerable progress in the preparation of a monograph on fresh-water fishes. He felt sure that he could command his own terms from publishers, and that the sale of the works would enable him to live in the quiet way he desired to do. So he went home for a year, which he spent in increasing his collections of natural history—now large and valuable—and in prosecuting the works on which he had been occupied at Munich. But his ambition to take a leading place among the naturalists of Europe, and the necessity for increasing his knowledge by study in some of the best museums of the Continent, led him at last irresistibly to Paris, where he arrived towards the end of the year 1831. From Cuvier he received much kindness. The veteran naturalist had made some progress with a work on fossil fishes, but when he saw what Agassiz had done and proposed to continue, he generously presented him with all his own drawings and notes upon the subject. A. von Humboldt also took the warmest interest in the young Swiss, aiding him by help of the friendliest and most practical kind. But Agassiz was still without any regular means of self-support; the publishing schemes were not so successful financially as he had fondly anticipated, and at last, after some months of over-strain among the treasures of the Paris museums, he gladly accepted, in the autumn of the year 1832, the offer of a Professorship of Natural Science created for him at Neuchâtel by the exertions of his friends. For the first time he had now the opportunity of appealing to a wider circle of listeners than his own fellow-students. The enthusiasm of his nature soon made itself felt in the new vigour with which natural science was followed in the canton. A Society for the prosecution of the study of nature was founded, with Agassiz as one of its leading spirits. Hill and dale, river and lake were explored far and near, and the systematic lectures of the class-room were supplemented by even more valuable discourses in the field. From this period onward a large part of Agassiz's time and thought was given to the promulgation of a knowledge of nature, not only to professed students but among the general public. With his extraordinary energy he still found time for an amount of original research that would have been more than enough for most naturalists. Bold almost to recklessness, in his disregard of financial difficulties, he now (1833) launched the first number of his "Poissons Fossiles," and, in spite of incredible obstacles, continued the preparation and publication of the work for the next ten years. In the course of his researches for this great monograph he came several times to England, bringing with him the artists he had trained in drawing natural history specimens, and spending much time in the public museums as well as in the private collections where he found such a wealth of palæontological material.

The "Poissons Fossiles" will ever remain as a monument of extraordinary industry and of a remarkable insight into the relationships between recent and extinct types of life. The keynote of all Agassiz's work in natural history sounds out clear and distinct in the introduction to this great work. He proposed a new classification of fishes which, though it has been subsequently considerably modified, was of great geological value in showing the true history and importance of the great order of Ganoids, which he first recognised. With a keen eye for real or supposed analogies and relationships, he saw in the earlier fishes of the geological record a commingling of ichthyic with reptilian characters which suggested to him his "prophetic types," and, following out the same idea, he made the startling announcement that in the phases of the embryonic development of our living fishes there is a close analogy to the successive types of fishes which have appeared in the past history of the earth. It is curious to remember that a naturalist who saw so far ahead of his contemporaries remained a consistent opponent of all theories of evolution. He admitted in the fullest sense the evidence of "the most admirable progressive development to which our own species is linked," but to him the progress was one of plan in the mind of the Creator, and not the mere material change of one form into another.

One of the most characteristic features of Agassiz's mind was its restless activity and untiring energy. The labour entailed by his great work on fossil fishes would have been enough or more than enough for any ordinary man. But while it was in progress he found time for the prosecution of his researches among recent fresh-water fishes; for an investigation of Echinoderms recent and fossil, and for the study of fossil Mollusca, and the evidence for these added labours appeared in bulky quarto memoirs with numerous plates. Besides these works, however, he undertook the almost incredible drudgery of compiling a zoological "Nomenclator," containing the names of living and fossil genera of animals, and a "Bibliographia Zoologiæ et Geologiæ," giving a full list of published papers on these sciences. Dissatisfied with the delays and defects of the Munich engraving establishments, he founded a lithographic workshop at Neuchâtel, and astonished the world by the beauty of the chromolithographed fossil fishes which he there produced, the art of chromolithography being then in its infancy.

With this mental activity was combined a bodily vigour which carried him unwearied through long excursions. As a recreation he turned to the glaciers of the Alps. Before his student days at Heidelberg he had made himself acquainted with that mountain-world. But in the summer of 1836, under the guidance of Charpentier, he began the systematic study of the glaciers. Before the end of that excursion he had seized the meaning of the scattered erratic blocks and ice-worn bosses of rock that lie far above and beyond the present limits of the ice. He saw as by a kind of inspiration the evidence for the former vast extension of the Alpine glaciers, and though he continued in later years laboriously to fill in the details of the picture, his first rough draft remained unchanged in all its essential features. As soon as he began to make known his ideas in glacial geology, he was met with a storm of opposition. Even his kind friend Humboldt could not forbear words of gentle reproof and warning. But he remained unshaken in his faith, and eventually had the satisfaction of seeing one after another of his opponents candidly acknowledge themselves mistaken. From 1836 to 1846 he continued with unabated enthusiasm his glacial researches, scaling mountain-pass and glacier, and publishing first his "Études sur les Glaciers" (1840), and then his "Système Glacière" (1846), besides separate papers in scientific journals. Among these minor contributions, undoubtedly the most memorable is the short communication made to the Geological Society of London in 1840 on the evidence of glaciers in Britain. Agassiz came to this country in that year convinced beforehand that there must be abundant evidence of former glaciers among our uplands. With the genial Buckland he went into the Scottish Highlands, and found everywhere, as he had anticipated, the most convincing proofs of ancient glaciers. From that time onward the study of Pleistocene geology took a new departure among the geologists of this country, and the opposition to glacial agency soon died out.

The "Poissons Fossiles" was followed soon after by the publication of the monograph on the fishes of the Old Red Sandstone—another land-mark in the progress of palæontology. Since the appearance of these works a new generation has appeared; the number and size of public and private collections have greatly increased, and the facilities for transport and for comparison of specimen with specimen have been enormously augmented. Those who revise the work of the great pioneer in fossil ichthyology will no doubt find much to amend, and no one knew this better than he himself. But they will not forget the difficulties under which he worked, and which he so pathetically describes. It was an enormous service to science to group and describe, as he did, all that was then known of the fishes of the past.

During the years in which Agassiz was engaged upon these and kindred researches he often turned his eyes wistfully to America as a land where many of the problems that so profoundly interested him could be even better studied than in Europe. There were many obstacles in the way of his crossing the Atlantic. In 1833 he had married the sister of his old college friend, Braun, and a young family was growing up round him. The emoluments of his Professorship at Neuchâtel were scanty enough even for his domestic needs, and he always had scientific work on hand that could not make progress without money. At last, however, he saw his way to visit America and pay the expenses of the journey by lecturing.

It was in the beginning of October 1846 that Agassiz arrived in Boston. Intending at first merely to make a lecturing tour, seeing what he could of the country and the people, but returning eventually to his home and its duties at Neuchâtel, he was gradually led to prolong his stay in the United States. His pleasant, genial ways, his captivating enthusiasm as a naturalist, and his activity of mind and body, gained him many friends; and at last, in the early part of 1848, he was offered and accepted the Chair of Natural History in a scientific school then organised in connection with Harvard University. Thenceforward he became an American citizen, and the record of his life is that of the growth of a remarkable personal influence which, holding up constantly before the public the claims of natural science for recognition, carried away all kinds of obstacles, personal, political, and financial, and planted firmly in the national mind a deep respect for scientific worth and the value of scientific training—an influence too which powerfully affected the young intellects that came in contact with it, kindling in them a spirit of brotherly co-operation and emulation in the study of nature. Without following the details of his busy and useful career, we may note the frequent excursions to distant regions for the purpose of gaining fresh materials for study. Thus we find the Professor at one time navigating the bays and creeks of Lake Superior; at another exploring the Florida reefs; then sailing up the Amazon and investigating its natural history; or dredging among the West Indies; studying glaciers in the Straits of Magellan, and voyaging up the western coast of America to San Francisco. Of these various expeditions narratives were published giving a pleasant picture of the life of the naturalists and of the chief scientific results obtained by them. Turning over the reports, we every now and then come upon some pregnant suggestion, some luminous generalisation, or some significant deduction, showing how the characteristic breadth of grasp and clearness of insight had undergone no diminution by transference to the New World. What, for instance, can be more suggestive than the sentence with which Agassiz begins one of his reports on these deep-sea dredgings? "From what I have seen of the deep-sea bottom, I am already led to infer that among the rocks forming the bulk of the stratified crust of our globe, from the oldest to the youngest formation, there are probably none which have been formed in very deep waters." In this conclusion and in his inference that the oceanic and continental areas have retained from the beginning the same general positions, he anticipates some of the most remarkable results of later research. Again, how prescient was his expectation that the deeper sea would show relics of older types of life that had vanished from the shallower waters!

One of the most important of Agassiz's labours in America was the founding of the Museum of Comparative Zoology at Cambridge—a museum which should not only present an orderly reflection of the structure and history of the whole animal creation, past and present, but which should contain such ample store of duplicates as to offer to students unlimited means of practical study, and should thus become one of the great centres for the radiation of knowledge throughout the community. To the realisation of his dream of founding such a museum he devoted the best energies of the last twenty years of his life, and lived to see it established and recognised as one of the great scientific institutions of the world. Full of labours to the last, happy in the hearty recognition of his scientific contemporaries, happier still in troops of friends in the Old World and in the New, and soothed by the tender affection of a loved home circle, Agassiz died on December 14, 1873.

The memoir which is the subject of this article has been written by his widow, whom he married in America after the death of his first wife. It is a most interesting narrative, bringing before us the man as he was, and, though making no pretence to appraise his scientific work, yet giving a graphic picture of the conditions under which the work was done. A simple boulder from the glacier of the Aar rests above his grave in the cemetery at Mount Auburn; a few sapling pine-trees sent from his old home in Switzerland throw their shadow over stone and grass. And no more fitting memorial could have been added to these tributes of affection than the story of his life so simply and gracefully told by Mrs. Agassiz.

ARCH. GEIKIE

OUR BOOK SHELF

Die äusseren mechanischen Werkzeuge der Thiere. Von Vitus Graber. (Leipzig: G. Freytag, 1886.)

THIS little work appears as the 44th and 45th of a series which, under the title "Das Wissen der Gegenwart," is published at Leipzig. The series embraces works on Astronomy, Geology, Physics, Biology, as well as treatises on History, Geography, Philosophy, and Art, all of which are issued at the extremely low price of one mark each. The present work consists of two parts, each of about 220 pages, with illustrations, and treats of the mechanics of the animal machine. The first part is concerned with the Vertebrates—where the construction is more complex—and in eight chapters we have the first principles of mechanics, so far as they relate to animals in general, discussed, and then the actions involved in locomotion, prehension, &c., are treated of in